Amended claim 1 recites that the actuator be configured with the following relationship between maximum detent torque Td and maximum rated torque Trate: Trate/4 ≤ Td ≤ 3Trate/4. As is explained by the inventors in the application on page 22, line 22 through page 23, line 15, the repetitive rotational range of the actuator tends to be narrower as the detent torque approaches the rated torque (especially so if Td > 3Trate/4). Also, if the detent torque is too small relative to the rated torque, the rotor cannot be held in a given position when the coil is deenergized. The inventors have found that the recited Td and Trate relationship of claim 1 provides an actuator with a satisfactory range of repetitive rotation, while still retaining a sufficient amount of detent torque to hold the rotor at a given position during deenergization.

The Office Action found that the inclusion of this limitation with the actuator of the claimed invention is obvious in view of the Horst reference in combination with Komatsu, Atsumi, and Igadoki. As the Komatsu, Atsumi, and Igadoki references (as well as the Haydon reference) are silent on this relationship, this discussion will focus on the shortcomings of the Horst reference, which is cited for disclosing the lower bound of the Td/Trate relationship, wherein Trate/4 = Td (see Horst, Figure 2). From this disclosure, the Examiner contends that it would be obvious to have the Td/Trate relationship of claim 1 for the purpose of providing rotor torque when the coil-excited reluctance torque is zero or negligible.

However, it is important to note that a person of ordinary skill in the art looking to design an improved actuator would not look to the Horst reference for guidance, particularly when seeking to improve an actuator's range of repetitive motion, because the Horst reference's reluctance motor is markedly different from the actuator of the present invention and because the Horst reluctance motor's torque relationship is highly dependent upon its markedly different design. According to Horst, its detent torque/coil-excited torque ratio is highly specific to its own kind of motor configuration because the ratio is highly dependent upon "the strength and placement of magnet 23 and the configuration of the rotor 15." (see Horst, column 5, lines 7-10). It is therefore important to note that the variable reluctance motor of Horst is of a markedly different configuration than the actuator of the present invention. The Horst reluctance motor does <u>not</u> incorporate the magnet within the rotor; rather the Horst reluctance motor has a <u>separate</u> magnet mounted on one of the stator teeth. The actuator of the present invention, however, incorporates the magnet in the rotor itself. Thus, when Horst teaches that its detent torque/coil-excited torque relationship is unique to its own magnet and rotor configuration, and when that magnet and rotor configuration is markedly different than Applicant's, Horst fails to provide a teaching with respect to torque relationships that is

applicable to the markedly different rotor/magnet configuration of the type claimed by Applicant.

Compounding the inapplicability of the Horst reference to the actuator of the present invention is the fact that the Horst motor does not provide repetitive rotational movement within a set angular range. Thus, not only are the structural properties of Horst different than that of the present invention, but the functionality desired for a reluctance motor is not the same as the functionality desired for an actuator (a broad repetitive rotational range is desired with the actuator). In fact, the Horst reference is utterly silent with respect to how one can improve the repetitive rotational range of actuators.

Therefore, a person seeking to improve the range of repetitive rotational movement in an actuator would not be guided by the Horst reference to use the Td-to-Trate relationship of claim 1 because of the marked differences between the Horst motor and the actuator of the present invention, and because of Horst's own statement that its torque relationship is unique to its own rotor/magnet configuration.

For an obviousness rejection to be valid, "the Examiner must show reasons that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed." In re Rouffet, 47 USPQ2d 1453, 1458 (Fed. Cir. 1998). In this case, Applicant submits that the obviousness rejection is improper because a skilled artisan confronted with the problem of increasing the repetitive rotational range of an actuator would not choose to follow the teachings of Horst, which relate to the operation of a structurally and functionally different motor. (*See* Wang Laboratories, Inc. v. Toshiba Corp., 26 UPSQ2d 1767 (Fed. Cir. 1993); *see also* MPEP 2141.01(a)).

Applicant therefore submits that claim 1 is nonobvious with respect to the Komatsu/Atsumi/Igadoki/Horst/Haydon combination, and respectfully requests allowance of claim 1.

Furthermore, Applicant respectfully submits that the Haydon reference, when viewed in combination with the Komatsu, Atsumi, Igadoki, and Horst references fails to disclose, teach, or suggest the limitation in claim 1 wherein the polar teeth stay within "a range of 220/N to 260/N degrees at central angle" (wherein N is the number of polar teeth). As disclosed on page 18, line 17 through p. 19, line 14 of the application, the inventors herein found that such a configuration of polar teeth produces an increase in the repetitive rotational range of the actuator. The Office Action contends that column 9, lines 14-19 (wherein Haydon teaches

that such "wide" stator poles provide higher output torque for the single phase electric motor and an increased magnetic saturation level for the stator poles, which thereby allows the motor to be power driven at input voltages substantially in excess of the rated voltage -- see Haydon, column 9, lines 1-19) teaches this limitation.

However, Applicant submits that a person of ordinary skill in the art seeking to improve the range of repetitive motion in an actuator would not look to the Haydon reference for guidance. Haydon deals with a rotating machine that is <u>not</u> configured for repetitive rotational movement. Haydon therefore provides no teaching with respect to increasing the repetitive rotational range of an actuator, and a person seeking to increase the repetitive rotational range of an actuator would not learn how to do so upon reading the Haydon reference.

As explained above, for an obviousness rejection to be valid, "the Examiner must show reasons that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed." <u>In re Rouffet</u>, 47 USPQ2d 1453, 1458 (Fed. Cir. 1998).

Applicant therefore submits that at the time of the invention, a person of ordinary skill in the art would not have found the invention of claim 1 obvious with respect to the five cited references. Applicant respectfully submits that it is only through impermissible hindsight, using the limitations of claim 1 as a road map, that the Office Action pieces together the current obviousness rejections from isolated disclosures in five references.

II. New claim 21 is patentable over the combination of Komatsu, Atsumi, Igadoki, and Yamaguchi because a person of ordinary skill in the art would not be motivated by the Yamaguchi reference to use an imbalanced magnet in an actuator.

Claim 21 includes the limitation previously found in canceled claim 6 wherein "either magnetic pole of said magnet is axially cut to forcibly destroy magnetic balance between the magnetic poles". As disclosed in the application on page 17, line 10 through page 18, line 13, such a groove or cut will produce an increase in the repetitive motion range.

The Office Action rejected claim 6 as being obvious in view of the Yamaguchi reference in combination with Komatsu, Atsumi , and Igadoki. As the Komatsu, Atsumi, and Igadoki references are silent as to such a rotor magnet, the discussion below will focus on the Yamaguchi reference.

Yamaguchi discloses a vibrator motor having an eccentrically-shaped rotor magnet (see Yamaguchi, Figures 2, 7, 9 -- the magnet has an arcuate/sectorial shape). Yamaguchi further discloses that this eccentrically-shaped magnet "causes vibrations when the rotor is rotated" and allows for the vibrator to vibrate without using eccentrically weighted output shafts, etc. (See Yamaguchi, column 2, lines 36-55). The Office Action contends that canceled claim 6 (whose limitation is now found in claim 21) is rendered obvious because it would be obvious to modify the combined Komatsu/Atsumi/Igadoki device with the eccentrically-shaped Yamaguchi magnet to produce a motor that does not require an eccentrically-weighted output shaft or an external eccentric weight.

However, Applicant respectfully submits that a person of ordinary skill in the art would not be motivated by the Yamaguchi reference to use an eccentrically-shaped magnet in the rotor of an actuator. Yamaguchi is addressed to vibrator motors, not actuators. In a vibrator motor, it is desirable to produce vibrations. However, vibrations are not a desirable result in actuators. Having no desire to increase the vibrations caused by the rotor, a person working with an actuator would not look to Yamaguchi for guidance in designing a rotor magnet.

The inventors herein found that providing a groove or cut in the rotor magnet increases the repetitive rotational range of the rotor, as more fully explained on pages 17 and 18 of the application. The Yamaguchi reference does not teach or suggest that this desirable result will flow from using an imbalanced magnet. Yamaguchi only teaches that the use of an imbalanced magnet will produce the undesirable result of vibration.

"[T]he Examiner must show reasons that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed." In re Rouffet, 47 USPQ2d 1453, 1458 (Fed. Cir. 1998) (*see also* Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co., 221 USPQ 481, 488-89 (Fed. Cir. 1984) (the initial obviousness inquiry must be gauged from the vantage point of a person attacking the problem solved by the invention, and prior art that does not suggest the claimed solution to a problem should not be used to render that claimed solution obvious); In re Benno, 226 USPQ 683, 687 (Fed. Cir. 1985) (a reference should be dismissed when that reference does not even hint at the problem that the appellants sought to solve)). The problem solved by the inventors herein is that of increasing the repetitive rotational range of the actuator rotor through the use of an imbalanced magnet. A reference teaching that an imbalanced magnet will cause vibrations in a vibrator motor (a result not desirable in an actuator) would not lead one of ordinary skill in the

art to incorporate an imbalanced magnet in the rotor of an actuator. Therefore, a rejection of claim 21 using Yamaguchi as a reference would be improper, and Applicant respectfully submits that claim 21 is allowable.

V. *Conclusion*

For the foregoing reasons, Applicant submits that the claims are patentable over the cited references. Favorable action is respectfully requested.

Respectfully submitted,

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MARKED-UP COPY OF AMENDED CLAIMS:
(Additions underlined; deletions bracketed)

1. (five times amended) A claw pole type actuator of a single-phase structure, comprising:

a stator yoke composed of a pair of substantially circular planar yokes formed of a soft magnetic material, a number N of polar teeth which axially protrude from inner peripheral edges of the respective planar yokes and which are disposed to face each other, extending in an axial direction, wherein each of said polar teeth has the same circumferential length, wherein said polar teeth stay within a range of 220/N to 260/N degrees at central angle, and wherein said polar teeth are disposed respectively at a spacing of approximately 180 degrees in terms of an electrical angle, and a cylindrical ring provided on outer peripheral edges of one of said planar yokes;

an armature being constituted by installing a coil formed by winding a magnetic wire in a coil receiving section shaped like an annular recess formed by said planar yokes, said polar teeth, and said cylindrical ring of said stator yoke;

a rotor being concentrically disposed within the stator yoke and being adapted for repetitive rotational movement within a set angular range in response to energization of said coil, said angular range being less than 360° and having its endpoints defined by a first angular position and a second angular position, and wherein said rotor is further adapted to be held in either said first angular position or said second angular position by a magnetic detent torque when said coil is deenergized, said rotor having a magnet, said magnet having a number N of magnetic poles, wherein a relationship between said detent torque and a rated torque is expressed as $Trate/4 \leq Td \leq 3*Trate/4$, wherein Trate denotes a maximum torque value in Nm when a rated current is passed, and wherein Td denotes a maximum torque value in Nm when a coil is in a deenergization mode; and

a stator assembly which has flanges with a bearing provided on both end surfaces of said armature and in which said rotor being installed to face said polar teeth of said stator with a minute gap provided therebetween, wherein said flanges are composed of a nonmagnetic material;

wherein a number of said polar teeth equals the number N of rotor magnetic poles.

2. (twice amended) An actuator according to Claim 1, wherein said stator yoke is comprised of a first stator yoke in which a planar yoke and a polar tooth are combined into one

piece, and a second stator yoke in which a planar yoke, a polar tooth and a cylindrical ring are combined into one piece[, and said polar teeth of said first and second stator yokes, respectively, are disposed at a spacing of approximately 180 degrees in terms of an electrical angle].

6. CANCELED

7. CANCELED

9. CANCELED

10. CANCELED